No.37 February-March1991

solplan review

the independent newsletter of energy conservation, building science & construction practice

Inside . . . .

As we change the way we build houses, we are more aware of the subtlies of house performance. Mechanical ventilation is something we are becoming more familiar with, and for which we are now seeing new standards emerging. Our major focus is on ventilation issues this month, as the province of Ontario has now mandated mechanical ventilation, while CSA has finaly completed its draft standard. We review the issues and the standard as it will be of interest to all builders, especially those encountering the situation for the first time.

Insulation alternatives are not considered often enough for the quality of job they do rather than just for their price. We review this issue, and discuss alternatives to commonly used fibrous insulations.

Other topics we look at include log construction; polybutylene pipe; news on new utility rate structures that will likely become a trend setter for other utilities; window labelling; a new housing code, and more.

Contents . . . .

Residential Ventilation 3
CSA F326: Residential Mechanical Ventilation Standard 4
Ventilation System Selection 7
West Coast Ventilation Study 8
Insulation Alternatives 8
Polybutylene Pipe 10
New Utility connection fees 10
Smart Windows 11
Window Labelling 12
Housing Code 12
Log Construction 13
TRC News 15

3921 Richard Kadulski L 91/07/01

Residential Ventilation

From the Publisher. . .

Regulations. Who likes them? We're faced with more and more of them all the time. We may want to scrap many. The marketplace should take care of any abuses, right? But will it?

We may not like it, but we live in a complex society. One person's castle is the next person's slum. Buildings have a long life and impact on the whole community. As a result, like it or not, the community wants to have a say in what and how the community is put together. It's no different than the developer who sets out design controls for a subdivision.

Rules and regulations have developed because too often where they haven't been spelled out, someone has taken advantage of a situation. Most regulations are a reaction. Some are legitimate, many may be frivolous. We've all encountered the absurd ones. But before you complain about the next asinine one, think how often have you've said ''there ought to be law...?''

We may like to believe that we are being sensitive to the marketplace, and do only what the public wants. But the process of designing and building a home is more complex and less market sensitive than making cabinets.

Often the home buyer (and too often the builder) is not aware of all the options available and what he should be asking for. Too often there are no trained professionals involved (especially in small buildings) and anyone can call themselves a builder, so our codes have become complex manuals that resemble elements of a how-to manual. That is why we see so many regulations.

Codes are becoming society's vehicle to ensure that more than basic structural, health and fire safety requirements are met. That is why issues such as security and energy standards are entering the code. We may not like it, but we haven't been responsive enough to these concerns. Regulations are seen as one way to ensure minimums are met.

The building industry has to decide if they stick to the principle to let the marketplace decide rather than regulate, and refuse to work with the agencies that are deciding what is going to be regulated? Or are we going to recognize that these regulations are going to be implemented anyway, in which case we can try to make the regulations workable?

If you don't get involved when these regulations are being prepared, then you can't complain after the fact that they are illogical or not practical.

Richard Kadulski
Publisher

solplan review

Editor-Publisher: Richard Kadulski
Illustrations: Terry Lyster
Contributors: David Hill, Michael Glover, George Pinch, Ken Manning
ISSN: 0828-6574
Date of Issue: March 1991
SOLPLAN REVIEW is published 6 times per year by:
the drawing-room graphic services ltd.
Box 86627, North Vancouver, B.C. V7L 4L2
Tel: 604-689-1841 FAX: 604-689-1841

Street address:
208-1280 Seymour St.
Vancouver, B.C. V6B 3N9

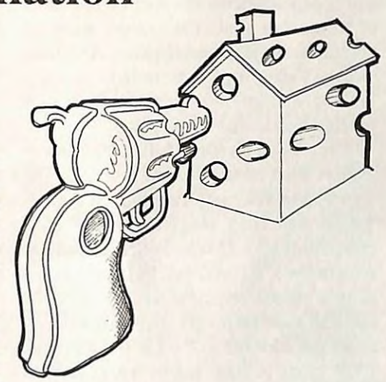
Second Class Mail Registration No. 6855
Postage paid in Vancouver, B.C.
COPYRIGHT 1991 by The Drawing-Room Graphic Services Ltd. All rights reserved. Reproduction without written permission of the publisher is strictly forbidden. Transgressors who don't take heed note: we'll send George after you!
SUBSCRIPTIONS: In Canada 1 year $38.52; 2 years $72.76 (includes GST). USA and other foreign payable in US $ 1 year $43.00, 2 years $82.00.
CHANGE OF ADDRESS: include a mailing label or copy all information off label for faster, accurate processing.
CONTRIBUTIONS: Unsolicited contributions and manuscripts welcome. Include self-addressed prestamped mailer if return requested. Publisher not responsible for loss or damage of same.
While every effort is made to provide accurate and complete information, we do not warrant or guarantee the accuracy and completeness of such information.
ADVERTISING POLICY: Publisher's discretion in the acceptance of any advertisement.
No endorsement is stated or implied by the publisher.
PRINTED IN CANADA
GST Registration: R105208805
SOLPLAN is a registered trademark of The Drawing-Room Graphic Services Ltd.

design & consulting
energy efficient building
consulting services
Quality Plus/R2000
design evaluations
HOT2000 analysis

Richard Kadulski Architect
208 - 1280 Seymour St,
Vancouver, B.C. V6B 3N9
Tel. (604) 689-1841

Residential Ventilation

Richard Kadulski



We have become aware of the importance for good quality indoor air to maintain healthy conditions under all weather conditions. This is why ventilation for homes has received a higher profile recently. Codes now mandate mechanical ventilation.

We've been writing about equipment and concerns on an ongoing basis since we started publishing SOLPLAN REVIEW in 1985. Unfortunately there's still lots of confusion about what good indoor air quality means and how to achieve it. There's a lot of poor equipment and too few qualified installers who understand how systems should be installed.

This is an issue of interest to the building industry not just because of new codes but because the consumer is now becoming more aware. Consumer publications are writing about it and educating the homeowner. The January-February 1991 issue of *Harrowsmith* magazine has a feature story on mechanical ventilation as have recent issues of *Popular Science* magazine. Other stories have appeared in the real estate pages of major papers.

Our metabolism consumes energy. We need oxygen that our bodies burn with the food we eat to produce carbon dioxide, water and other byproducts. If we don't replenish the oxygen, then dangerous concentrations of carbon dioxide and other compounds will build up. If you've ever woken up (especially on a cold winter day when the house has been shuttered) feeling hung over, even when you didn't have a drink the night before, you could have had a mild case of carbon dioxide poisoning due to inadequate supply of fresh air.

Despite the evidence that we are dealing with a fundamental principle many are still sceptical. Questions we still hear are: why do we need to add fans? Is it really necessary? We've been building for generations without it and there's been no problems. Isn't this just adding unnecessary cost to the homeower? Maybe we shouldn't be building such tight houses? The list of questions goes on. We've all heard many variations on this theme.

The fundamental reason for mechanical ventilation is to provide good indoor air quality to ensure healthy indoor conditions. Remember that a house is a system, more than the sum of the components.

We don't build houses the way we used to in the past, as we use new products and materials to make our houses tighter and draftfree. This means the house operates differently than in the ''old days'' when houses were leaky. Older houses didn't use much insulation, they may not have been kept as warm and comfortable as they are today, the houses were drafty and uncomfortable, and often had naturally aspirating combustion appliances.

The early sod huts on the prairies, the old log cabins, even city homes were full of smoke and soot and chilly rooms, ice on the windows. Today's homes use panel materials (plywood, waferboard, drywall, etc), new caulking materials, tighter doors and windows, and more efficient heating systems. This has meant that the average home today is built tighter with less natural air exchange so pollutants generated inside are being trapped indoors.

Even older leaky houses often have poor indoor air quality, even though it may not have been obvious enough to create major problems. As long as we didn't know any better, we put up with it. It was just the natural state of affairs, just as we put up with big city pollution until it got bad enough to be noticed. The R-2000 program helped to identify just how bad the situation was. The stress on airtight construction practices for new energy efficient homes were monitored in great detail for indoor air quality (as well as energy consumption). For comparison standard housing was also monitored. It was discovered that conditions in existing housing weren't that good.

Today's homes are not just energy efficient, but also more comfortable as well. Home owners who bought the early R-2000 homes were buying them mainly for their low energy consumption. On moving in they discovered the pleasures of a quiet, draft free environment that maintained fresh air without having to keep windows open.

The challenge is how to develop, market and install simple, least costly ventilation systems that work.

Code changes

The latest edition of the Ontario Building Code has adopted the mechanical ventilation requirement of the National Building Code. For many builders the question now is how to satisfy the code requirements. The Code merely states that every dwelling unit shall be provided with a mechanical ventilation system having a capacity to exhaust inside air or to introduce it at a rate of not less than 0.3 air changes per hour, averaged over a 24 hour period.

The 1985 edition of the National Building Code had the same requirements but Ontario did not adopt the ventilation section. In B.C., it was adopted. Within a year the confusion led to requests for changes. Many said it wasn't needed and the ventilation passage should be deleted. On reflection after input from many groups, including HRAI and the Technical Advisory Committee of the CHBA-BC, it was decided that it was more important to make it workable and a bridge to CSA F326. The CSA F326 standard, then in a draft version, was used as a reference so that the code would not contradict its intent. As a result, the mechanical ventilation section was expanded.

The B.C. Code still has short comings, but is easier for builders to use, and inspec-

tors to verify compliance. The results mean that conditions due to inadequate ventilation are less likely to encountered in new housing.

Who's responsible?

One reason for the confusion about ventilation requirements is uncertainty about who is responsible.

In the past fans were selected and installed by the electrician. Ducts, hoods and fittings were handled by someone else. However, airflows through a duct, fitting and fan are affected by how the whole is put together. Every elbow and fitting adds resistance that reduces airflows. Some duct hoods and screens can put so much resistance on the end of a straight piece of duct that air flows are reduced to almost nothing. A simple 4" vent cap, on the end of a straight 6 foot duct run (with no elbows or flex duct) imposes enough resistance that a fan rated at 85 cfm (at 0.2" water gauge) actually delivers as little as 30 cfm.

The performance of a ventilation system is dependent on all other components of a house as well. The builder must be familiar with what is required and take charge of ensuring it is installed correctly. Trained ventilation specialists are a new specialty trade that is emerging.

Even when a system is installed, home owners must be shown how it works. The New Home Warranty Program of B.C. & Yukon has been receiving many calls complaints about excessive condensation on windows, odours, etc. In most cases a simple phone explanation resolves the problem as homeowners are instructed how to set the controls so the fan is turned on. Even many R-2000 homeowners are not certain how to maintain the equipment and what correct settings should be. If you install something, make sure the homeowner (or relator) is told how to use it.

Principles of good design

There are several principles that all ventilation systems should meet.

Proper fan selection: Installed fans must be able to move required air flows, (taking into account resistance built into the system). Poor duct layout or fans without adequate capacity will not move much air.

Equipment must be quiet: a good ventilation system will run for long periods of time at a low velocity. If the equipment is not quiet, residents will find a way to shut off the fan (can you sleep with the noisy range hood fan running?).

The system should have **automatic controls**, so that it is not necessary to rely on someone to turn on the system.

With many different options available how do you know what is going to work? Is one system better than another? System design must not create undue stress on the house (positive or negative).

To be effective, systems must be technically sound, cost effective, readily available and easy to install and use by home owners.

CSA F326 Residential Mechanical Ventilation Systems Standard

Richard Kadulski

A standard for residential ventilation has finally been finished. It spells out requirements for mechanical ventilation systems in single family, semi- detached and row housing (defined by Part 9 of the National Building Code of Canada). It is a very comprehensive document, the result of input of a lot of people in the mechanical and building industry, based on the best knowledge available at the present. While the standard is not intended for apartments, ventilation air requirements of these should be similar.

As with all Canadian Standards Association (CSA) standards, it was prepared by a technical committee that included persons from all sectors of the residential building industry, including ventilation equipment manufacturers, contractors, R-2000 program administrators, building inspectors, government and utility representatives.

The underlying thought behind the standard is the principle that a house operates as a system.

Most houses have a variety of venting equipment that move air in and out of the house. The leakage characteristics of the envelope, weather conditions, exhaust devices not part of the ventilation system and the venting properties of combustion appliances (including fireplaces) will all affect indoor/outdoor pressure differences acting on the house and thus in turn the performance of combustion and ventilation equipment. CSA F326 considers these as they relate to the whole house, so that ventilation solutions do not create other problems.

Uncontrolled air leakage, natural ventilation through open windows, or other openings operated by the residents are not taken into account. They are not considered adequate to provide fresh air even though uncontrolled leakage through the building envelope will affect and may add to the ventilation provided by the mechanical system (but this will be significant only in the most extreme weather conditions).

The standard spells out ventilation system requirements; equipment and installation requirements (the "how to": workmanship, materials, equipment, insulation requirements for ductwork and system design); and compliance methods (how the installer and inspector are to check an installation to see if it meets the requirements of the standard). It is intended that this standard will displace CSA standard C444 (Installation Requirements for Heat Recovery Ventilators).

The minimum system capacity is defined; it does not order homeowners to operate the system. The installed capacity must meet the generally recognized needs, but there should be enough flexibility for the resident to be able to adjust ventilation flows to meet their specific needs for humidity control and fresh air requirements. (As with heating, we install heating systems capable of maintaining indoor temperatures but it is the resident who determines what is comfortable for them).

A unique feature of the standard are the four appendices. Appendix A provides a commentary in the intent behind the specific requirements; appendix B explains the rationale for the various requirements; appendix C gives illustrated sample system designs and the calculations to determine them; and appendix D explains measurement techniques. The appendices are not mandatory parts of the standard, but a guide to make it understandable.

What is the scope of the standard?

Ventilation is meant to deal with occupant generated contaminants at the rate normally generated in dwellings. Good indoor air quality also requires that contaminant generation be controlled, but that is an issue beyond the scope of this document. It is assumed that outdoor air is suitable for ventilation. In areas with exceptionally poor outdoor air, other measures beyond the scope of the standard may be required (e.g special filtration and air cleaning). Fortunately, there are not too many such locations in residential areas, most would be industrial sites.

Maximum depressurization limits that can be imposed on the whole house (created by the ventilation system or other exhaust appliances) are spelled out. The intent is to minimize problems due to backdrafting of combustion products.

The combustion air needed for fireplaces or to supply make-up air to replace that exhausted through the fireplace flue are not considered by this standard. Such requirements are beyond this standard, but that is why the limits on allowable depressurization are spelled out.

ABOUT UNITS

The CSA standard uses metric units only. Not to create undue confusion or introduce errors, we are using metric units only.

If you must convert to imperial units (to cubic feet per minute):

5 l/s = 10.59 cfm

Definition of Terms

Terms used in ventilation are defined. A few key ones are:

Bathroom: any room containing a toilet, urinal, bidet bathtub or shower.

Conditioned volume: includes the total interior heated volume including basement, but not garage or crawl space.

Exhaust air: air removed from a space and not reused.

Habitable room: any space designed for human occupancy such as bedroom, den, living, dining, family, recreation room or kitchen (in other words any room not

TABLE A: MINIMUM VENTILATION REQUIREMENTS

SPACE	MINIMUM VENTILATION CAPACITY	INTERMITTENT EXHAUST	CONTINUOUS EXHAUST
CATEGORY A			
Master bedroom	10 l/s		
Single bedrooms	5 l/s		
Living Room	5 l/s		
Dining	5 l/s		
Family	5 l/s		
Recreation	5 l/s		
Basement	10 l/s		
Other habitable rooms	5 l/s		
CATEGORY B			
Kitchen	--	50 l/s	30 l/s
Bathroom	--	25 l/s	10 l/s
Laundry	5 l/s		
Utility room	5 l/s		

- Ventilation requirements for combination rooms must be calculated as for individual rooms
- "Other" does not include spaces such as hallways, landings, storage rooms vestibules or access spaces.
- Unfinished basement areas used for other purposes (if they are more than 2/3 of basement area) are vented at 10 l/s; if less than 2/3 then it's vented at 5 l/s

strictly for storage or utility purposes).

Make-up air: outdoor air to replace exhaust air.

Occupied zone: the area between 3" and 5'10" above the floor within an occupied space, and more than 2' away from the wall or fixed air conditioning equipment.

Utility room: a room containing laundry or maintenance equipment and materials, or used as a workshop.

Mechanical ventilation systems and equipment must be installed in accordance with the appropriate sections of Part 6 of the National Building Code.

Ventilation Requirements

Ventilation provides fresh air for the residents so the amount must match the expected number of occupants as r.equired air flows are based on the number and types of rooms in the house.

Two types of areas are defined: Category **A** rooms are living areas that are to be supplied with fresh air, Category **B** rooms are the service rooms that are the source of moisture and odours, and not normally occupied for extended periods. Air removed from bathrooms and kitchens must be exhausted to the exterior.

The ventilation system must be designed so that it can operate on a continuous basis and provide a flow rate that is calculated by taking the sum of individual room requirements (see Table A) or 0.3 air changes per hour based on the conditioned volume of the house (whichever is greater). Unless the fresh air is distributed, there is little benefit from the ventilation air in areas removed from the source so ventilation air must be distributed throughout the occupied zone. Short circuiting from supply to return air grilles must be avoided.

Service rooms can be supplied directly or by air flowing through from other rooms, though transfer grilles or undercut doors if supply comes from adjoining rooms.

Because some systems must be shut off from time to time (e.g. during defrost cycle of those HRV's that defrost by shutting off) the standard states that the shut off time should not be more that 1 hour in any 2 hour period and the average ventilation air flow in any 24 hour period meets the minimum needed.

Recirculating systems

When the ventilation air is distributed through a central recirculation system with a continuously operating blower (as in a forced air heating system), the ventilation criteria for the living spaces (type A rooms) is met if the total air continuously supplied or removed at least 20 l/s. For service rooms (type B), at least 5 l/s must be supplied or removed.

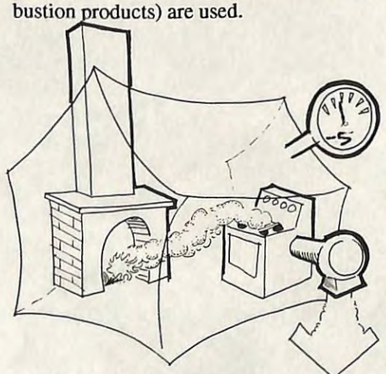
Kitchens and bathrooms must be exhausted on a continuous or intermittent basis at a rate as noted in Table A. Exhaust air must be taken outside, and not recirculated.

Supply air must be introduced in a way or at a temperature that the ventilation air does not create discomfort in the occupied zone.

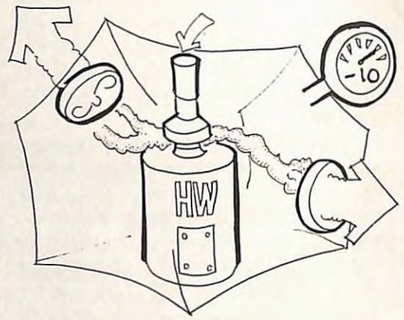
If cold air is brought into the return air plenum of fuel fired appliances, it must be tempered and/or mixed with return air so that the temperature of the air as it reaches the furnace heat exchanger is not less than 12°C.

Pressure Design Limits

The house must not be depressurized by more than 5 pascals if naturally aspirating combustion appliances (units that take combustion and dilution air from the house, and depend on natural draft to vent combustion products) are used.



When operating at minimum capacity, the ventilation system must not generate pressures of more than 10 Pascals between inside and outside (either positive or negative) or the limit to which any vented



combustion appliance has been certified, whichever is less.

To determine the airflows that may create a pressure imbalance, the sum of the minimum required ventilation rate, plus the exhaust from the clothes dryer (75 l/s is the default value), and the largest exhaust fan (other than the base ventilation and the dryer) must be considered. Design of special make-up air supply is critical. If cold air is introduced where residents feel drafts, they will plug the holes and disable to the make-up air thus defeating the object.

Equipment must be installed in accordance with the applicable electrical code. Packaged ventilators must be accompanied by "up-to-date, clear, correct and comprehensive instructions" for determining performance, installation and operation.

Installation

Systems must be sized and installed according to good practice and suppliers' instructions. Design and installation procedures outlined in HRAI and ASHRAE manuals and standards are considered to represent good practice.

The heat recovery ventilator installation standard contains many points of good system design and layout.

Air flows must be capable of being adjusted so that they can be adjusted to meet house pressure limits and allow adjustment of air supply rates to individual rooms. Exhaust air must be moved to the exterior, directly or through a duct.

Attention to details must be paid to reduce noise and vibration from mechanical equipment.

Where dampers are used to balance and adjust airflows, they must be accessible so that it is not necessary to remove the fan, insulation or other building components to adjust them.

Ducts must be permanently supported and assembled to minimize air leakage at joints. Good practice should follow the commercial sector custom of using a brushed-on duct sealer at all junctions. Joints between ducts and the exterior building envelope must be caulked or sealed so that the air barrier is maintained. Where ducts pass through unheated spaces, or cold air passes through heated spaces, ducts must be insulated (minimum R2.89, more depending on local winter design temperatures).

Air intakes must not be located where they will pick up contaminants such as garbage smells, gas meter vents, auto exhausts, or other pollutants. They must be at least 18 inches above grade or above local snow line. Exhaust outlets must be at least 4 inches above grade.

Dedicated ventilation supply air grilles must be located to minimize discomfort from cold drafts. These should be within 12" of the ceiling and designed to promote diffusion across the ceiling.

Kitchen exhaust: if range hoods or range top exhaust fans are not installed, kitchen exhaust ventilation must be located near the ceiling to capture and remove smoke and vapours. Where range hoods are installed, they must be fitted with grease filters at the intake, have a minimum capacity of 50 l/s, and be exhausted to the outside.

Verifying compliance

The standard spells out several tests that can be used to ensure the system is in conformance with the standard. Accepted design procedures, done by a recognized designer or by testing (by a professional or certified trades person) are adequate to comply with the standard. A form for the installer to sign indicating how the system was designed or checked is provided.

CSA Standard: F326: Residential Mechanical Ventilation Systems 1990. Canadian Standards Assoc. 178 Rexdale Blvd. Rexdale (Toronto), Ont. M9W 1R3

Commentary

As any regulatory document, CSA F326 is written in a very academic way that takes some effort to figure out what it is really saying. It is not bedtime reading (unless you have insomnia). But it is a very impressive and comprehensive document that wisely recognizes the house as a system greater than the sum of its parts.

It requires that ventilation air be distributed throughout the dwelling. The biggest problem with many houses that have a centrally located exhaust ventilation is that there is not enough distribution. As it is assumed that replacement air will filter through the whole house. However, that uniformity is seldom there.

The required ventilation rates are designed to provide enough air for typical occupancy situations. They are based on the assumption that a ventilation air flow of 7.5 l/s (15 cfm) per person is needed to control the contaminants generated by human metabolic processes. For control of CO_2, the minimum is about 5 l/s for persons at rest.

For average sized families, the rates of ventilation air will be supplied at a rate of 7.5 l/s per person. The appendix suggests that if the number of persons to occupy a room is known, the minimum flow rate should be adjusted to provide a minimum of 5 l/s per person.

People are increasingly living in larger dwellings with more rooms per capita than ever before. The average Canadian household size is 2.8 persons (down from 3.9 in 1961). In this case mechanical ventilation at the continuous rate based on the number of rooms or volume of the house may be excessive. The ideal ventilation system will be fully demand controlled, and CSA F326 does not obstruct this.

Does this standard bias ventilation systems to heat recovery ventilators?

Perhaps in some cases this may seem the case. But in all parts of Canada (perhaps with the exception of coastal B.C.) climate and energy considerations suggest that heat recovery technology (in whatever form) should be used, from environmental and energy conservation perspectives.

Ventilation not only provides fresh air, but is also the main way to dehumidifying a home. The humidity in dwellings (during the winter) is dependent on the rate of moisture generation, the amount of moisture removal at its source, and the dehumidifying effect of ventilation. In large under occupied homes, ventilation at the specified rates can over ventilate the home, and thus dry it excessively. This not only is uncomfortable (generating static shocks) but it is not healthy, since dry conditions are ideal for bacteria and viruses as well as aggravating respiratory ailments.

In smaller homes, which may have higher occupancy, humidity problems are serious. This standard may not deal adequately with this issue.

A flexible control strategy must be accommodated so that occupants can control airflows to levels suitable for their comfort.

Perhaps the major beef is that F326 is too complex for the industry. More training and education is needed, and a greater variety of good equipment needs to be developed. However, as yet it has not been implemented by any jurisdiction so there is time for industry to familiarize and prepare. If we recognize that there is a need to ensure adequate ventilation in homes, it must be done properly from the begining.

Ventilation system selection

Choosing the appropriate ventilation system is to meet occupant needs and code requirements is not straightforward. There is no single "one size fits all" solution. The lower the budget available, the more limited your options will be. The following are a few key points you must know:

1. House volume: this will determine required ventilation capacity to meet code.
2. Is there an exterior chimney in house (a fireplace or other masonry flue on the outsidewall)? These typically are sources of uncontrolled infiltration as cold air falls down the flue into the house and brings with it creosote smells.
3. Is there any open combustion equipment in the house? This will determine if

special make-up air supply is needed.

4. Is there a downdraft cooktop? These have such strong fans that they usually require make-up air.

5. What kinds of other exhaust fans are there in the house?

6. How are you going to distribute fresh air through the house?

7. What type of heating system is there: forced warm air or something else?

8. What are the fuel costs?

9, What are the winter design temperatures?

The West Coast experience: a study

On the west coast we have a wide range of house styles and mechanical systems. To determine how well various systems work, analyze costs and how well they integrate into new home construction, CMHC and B.C. Hydro sponsored a project in Victoria, with the participation of the Victoria Home Builders Association. The study was commissioned soon after the B.C.Code introduced, when building inspectors as well as builders were not certain what was acceptable.

8 systems (in several operating modes) were monitored over 2 years. The study gathered much information. Unfortunately, the project was not executed well and the objective of the study seems to have been lost as the work progressed. It was hoped that at least 3 technically sound, cost effective ventilation strategies for new and retrofit residential construction were going to be identified.

A lot of useful was data gathered, but the overall conclusions presented are not. They provide anecdotal information rather than data on which valid conclusions can be made.

The study conclusions provide information for items that weren't investigated. In the case of a variable air-flow ventilation system it was discovered that the equipment was not installed correctly, but the report carries on with the analysis of its operation anyway as if the results are valid. The only conclusion to be drawn is that equipment not installed according to manufacturers' instructions will not work as the manufacturer claims!

Costs? The price range of the various systems tested was $450 to $2,500. The report says "whether the added cost of the sophisticated systems is justified is a widely debated topic". But that was why the study was commissioned in the first place!

The most significant observation made is that proper system design and installation is important. This requires competent installers and/or inspection on commissioning of systems.

The report results prove the saying that you can prove anything you want with a lot of numbers.

"West Coast Ventilation Strategies" prepared by Avalon Mechanical Consultants for CMHC.

To their credit, HRAI-B.C. chapter organized a hands on course that covers the B.C. ventilation code requirements. The course is aimed for the mechanical trades, and on successful completion of the course they are listed as certified ventilation installers. To date over 500 persons (including building inspectors) have taken the course. This is creating a qualified specialist ventilation trade in the province.

Richard Kadulski

Insulation Alternatives

Common thinking among builders and home buyers has been that glass fibre insulation (batts or loose fill) is the best choice for performance and reliability. That thinking is beginning to break down with a greater use of prefabricated, pre-insulated wall systems.

Alternate materials are often viewed with some reservation. Use of alternates is usually considered to reduce costs rather getting a better job.

The lower the density, the lower the R-value of Glass fibre insulation. As with any preformed board or batt the job is only as good as the fit. Too often site work is pretty poor.

How not to install batt insulation

Loose fill insulations

Over fluffing is probably the most serious concern. The manufacturing process creates thin springy fibres that when blown into a pile create an impressive volume of material that has relatively little substance or mass. To yield an R-value of about 2.66 per inch glass fibre has to be installed at a density of about 1 pound per cubic foot (pcf). Material applied to a depth of 15" should in theory have R-40, but it is easy to apply at a density of only 3/4 pcf, in which case although there may be 15" of fluffy material the actual R-value will be about R-30. The reduction in R-value will not be apparent at first because the required volume appears to be in place. It is not likely to be mentioned by an unscrupulous installer who benefits by using less material than he is charging for. This is why manufacturers spell out the number of bags per area to provide adequate coverage. It is always important to check the number of bags used not the depth of coverage.

The R-value of blown glass fibre is about 40% less per unit of thickness than the R-value of cellulose insulation, which is sig-

Canada Post is at it again!

Developers know that Canada Post no longer offers home delivery in new subdivisions. Instead, they provide group boxes which are a more cost effective way to deliver mail.

Canada Post, in it's effort to "improve service" is at it again. This time, 800 customers at the North Vancouver Post Office have been told to get lost - find some other place to collect their mail. Among services to be cut include the closure of 800 postal boxes. The majority of the customers are small businesses, (like Solplan Review) who opt to use the postal box for convenience and security of a stable permanent address, (we've been using our P.O. box address for over 14 years). It is hard to understand how closing a single delivery point for 800 customers (to be dispersed throughout the community) is going to be more cost effective.

The most asinine aspect of the North Vancouver Post Office decision is that the office will still be staffed, as a small select group of major corporations is still going to have boxes there and counter service is being maintained for business customers boxholders pay for the privilege of collecting their mail there.

It is disturbing to see the federal government has abdicated responsibility for the postal service. As many readers, especially those in rural and smaller communities know, you can't do everything by FAX or courier. We firmly believe the postal service still is and will continue to be a vital link to allow us to communicate with each other, despite the efforts of a management that has forgotten it is there to provide a customer service, not just look at the bottom line and to hell with the customer!

As you may have gathered, I'm mad at the incompetence of the post office. I'm still fighting the postal closure, but if the small minds at Canada Post prevail, we will be forced (with no compensation offered) to obtain a new address this summer. If it comes to pass, we will be sure to keep you informed.

Richard Kadulski

Don't miss out!

Stay informed about the latest developments in building technology. If you are not yet a subscriber to SOLPLAN REVIEW, do it TODAY!

Don't be left out in the cold!

You can FAX your order: (604) 689-1841

solplan review

the independent newsletter of energy conservation, building science & construction practice

SUBSCRIBE TODAY!

SOLPLAN REVIEW is an independent Canadian newsletter published 6 times per year to provide news, technical details, new product information, insights and commentary on developments covering all aspects of building science and energy efficient building practice for new and retrofit residential construction.

SOLPLAN REVIEW serves the needs of professional and interested lay persons. Technical information is presented in a clear, concise manner, without resorting to jargon.

As an independent subscription supported publication, we rely on the support of our readers. If you are seeing this publication for the first time, and find it valuable, why not ensure you don't miss any copies. Subscribe today!

YES, I WANT TO SUBSCRIBE TO **SOLPLAN REVIEW**
In Canada: 1 year: $38.52 ($36.00 + 2.52 GST)
2 years: 72.76 ($68.00 + 4.76 GST)
USA and other foreign:
1 year: $ 43.00 per year
2 years: 82.00
(u.s.a. and other foreign in u.s. funds).

payment enclosed please bill us P.O. #_____

please charge to credit card:

VISA MASTERCARD AMERICAN EXPRESS

card number: _____ expiry date:_____

signature: _____

name: _____

address: _____

_____ post code: _____

the drawing-room graphic services ltd.
box 86627 north vancouver, b.c. V7L 4L2

THE BOOKSHELF

A selection of books that will be of interest to our readers. Price and availability subject to change without notice. All orders shipped by bookpost. Please add $0.75 per book for postage and handling ($2.50 max. per order);
outside Canada: $1.50 per book ($5.00 max. per order).
CANADIAN ORDERS PLEASE DON'T FORGET TO ADD 7% GST

HEAT PUMPS: An efficient Heating & Cooling Alternative
by Dermot McGuigan. In some areas a heat pump can reduce electric bills 35 to 45 percent. An informative introduction to the subject.
$11.95

CHEMICAL ALLERGIES
by Dr. Richard Mackarness. Discusses the impact of chemicals used in food and household products on humans. $9.95

RADON: The Invisible Threat
by Michael Lafavore. Radon is a colorless, odorless and tasteless radioactive gas that gets into houses. RADON defines what it is, where it is, how it can contaminate a house, practical steps to overcome the problem in new construction or in existing homes. $15.95

SOLPLAN 6: An Air Exchanger for Energy Efficient Well Sealed Houses
A do-it-yourself manual for building a heat recovery ventilator; developed by the pioneers of low energy building technology at the University of Saskatchewan. $6.95

1991 CONSUMER GUIDE TO HOME ENERGY SAVINGS
Listings of the Most Efficient Products You can Buy and much more. Contains information on how to get the most benefit from the new household equipment. Includes product listings (by make and model number) and performance ratings for household mechanical equipment and appliances. $8.35

YOUR HOME, YOUR HEALTH, AND WELL BEING
by David Rousseau, W.J. Rea, Jean Enwright. What you can do to design or renovate your house or apartment to be free of outdoor and indoor pollution. By knowing what pollutants affect our homes, and applying carefully explained step-by-step solution, dwelling can be transformed into healthy, quiet clean pleasant places. A special detailed section gives recommendations for those with environmental sensitivities.
$19.95

THE COMPACT HOUSE BOOK: 33 Prize Winning Designs - 1,000 sq.ft. or Less
Don Metz, editor; The designs presented were winners of a Garden Way Compact House Design Competition. Shows a range of designs stressing low energy, modest cost, & how small houses can be imaginative & comfortable living spaces $19.95

FINE HOMEBUILDING ON FLOORS, WALLS AND STAIRS
31 articles from Fine Homebuilding magazine compiled into this illustrated book that covers designing and building stairs; staircase renovation; preparing and finishing walls; ornamental plaster & raised panel wainscoting.
$16.95

FINE HOMEBUILDING ON BATHS AND KITCHENS
Reprints of some of the best stories from Fine Homebuilding on the most popular renovation projects. Expanding kitchens; European style kitchen cabinetry; remodelling a bath; and much more. $16.95

THE TIMBER FRAME HOME Design, Construction, Finishing. by Ted Benson
The age old craft of timber framing has gained new life in recent years. This illustrated book covers the fundamentals of the craft and the range of design and structural options available.
$24.95

WINTERGREENS: Solar Greenhouses for Cold Climates by Mark Craft
The complete guide to building and operating a greenhouse in cold climates. This book examines all aspects of theory, design and construction, with special emphasis on attached greenhouses.
$12.95

CLASSIFIED

FIREPLACE DAMPERS
Winter is with us still. If you have an old masonry fireplace that is seldom used, and find that it only keeps the room cold, here's your opportunity to reclaim the room. The **Davic Heatsaver** is an inflatable damper that fits most fireplace dampers like a snug pillow. It reduces down drafts through the fireplace, and reduces energy losses up the flue. It'll pay for itself in the first year.
Only $36.00 (plus $2.50 for postage & handling)

the drawing-room graphic services ltd.
box 86627 north vancouver, b.c. V7L 4L2

WANTED Advertisements for products or services that would be of interest to SOLPLAN REVIEW readers. Reach over 4,500 members of the Canadian home building industry through a classified add in SOLPLAN REVIEW. Contact us for details. box 86627 north vancouver, b.c. V7L 4L2. FAX (604) 689-1841

Please circle items you wish to order. Total $_____
Please charge to credit card:
VISA MASTERCARD AMERICAN EXPRESS

Card NO. expiry _____ _____
signature _____
NAME: _____
_____
ADDRESS:
_____
_____ POST CODE_____

the drawing-room graphics services ltd.
box 86627 north vancouver, b.c. V7L 4L2

CALENDAR

Solar Home Program - Sept. to May, 'how-to and 'hands-on' series of Workshops on solar home design and construction. Contact: Solar Technology Institute of Colorado, P.O. Box 1115, Carbondale, CO. 81623 Tel: (303) 963-0715

MECHANICAL COURSES Over 130 courses for mechanical trades are being offered across Canada in the following subject areas: Handling of CFCs/HCFC's; Business Management Residential and Small Commercial Heating & Load Calculations and Air Systems Design; Residential Mechanical Ventilation Installation

Other courses available based upon regional needs: For course descriptions, dates, locations & fees contact: HRAI, 5468 Dundas St. W Suite 308, Etobicoke, ON M9B 6E3 Tel 416-239-8191 Fax 416-239-1983

Building Better Condominiums; "Survival & Opportunity" CMHC and the Ontario New Home Warranty Program present a one day symposium: Ottawa - **April 10, 1991;** Toronto - **April 12, 1991**

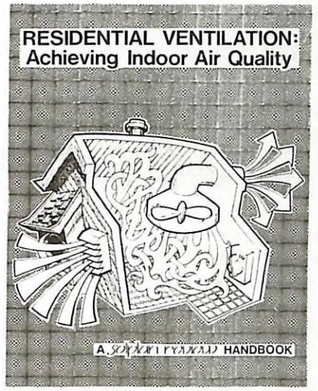
Topics include: Bulletin #19; Greening Issues
Administrative Program: Receiverships & Bankruptcies; Case Studies; Building Affordable Condos; Integrating Property Management Issues In Design
Technical Program: Windows; The Building Envelope; Soils; Below Grade Problems; Sound Transmission
For information: Robert Marshall, Ontario New Home Warranty Program; Tel: 416-229-3810 (Toronto)

Super Windows: new technology in glazing spacers, gas fill, low-e glass. **April 3, 1991** Toronto, Ont. For information: Edgetech I.G. Ltd. Ottawa (Tel: 613-749-0624)

Canadian Home Builders Association National Conference: May 12-15, 1991 Montreal, Que. For information: CHBA National Office Tel 613-230-3060

The Conference on Energy & Environment, The Next Generation. 17th annual conference of the Solar Energy Society of Canada. **June 23-26, 1991**, Toronto, Ont. Includes energy conservation, solar shelter workshop, windows, and more. Information: SESCI Tel. 613-236-4594

Builder's Forum: Training for Tough Times. **April 25-27, 1991.** Victoria B.C. A range of workshops of interest to builders. Details, information: CHBA-BC Tel 604-432-7112



RESIDENTIAL VENTILATION: Achieving Indoor Air Quality

The book that tells you how to deal with indoor air quality and ventilation issues.
RESIDENTIAL VENTILATION: Achieving Indoor Air Quality describes why ventilation is necessary and how it can be provided, effectively and without creating resident discomfort.
This book is of special interest to builders and designers.

CONTENTS
1. Indoor Air Quality: why be concerned
2. Dealing with Indoor Air Quality: how to control pollutants sources
3. Ventilation System Design: what design criteria should be
4. Basic Ventilation Systems described
5. Codes and Standards: what they call for and how to comply
6. Equipment Descriptions
7. Glossary of Terms
8. Sources of Information

WRITTEN BY: Richard Kadulski; Illustrated by Terry Lyster; Technical consultants: David Hill and Yvonne Kerr.

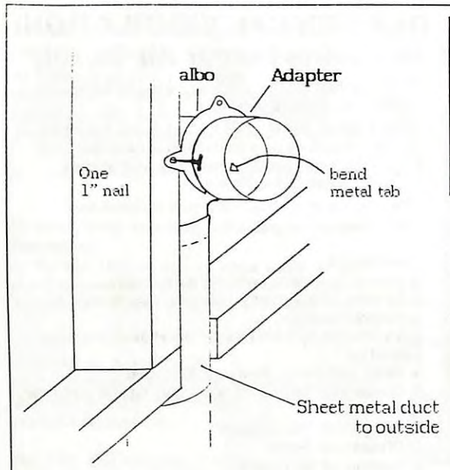
ORDER YOUR COPY TODAY! ONLY $11.95 per copy

ORDERS MAY BE PAID BY CHEQUE, VISA, MASTERCARD, OR AMERICAN EXPRESS

card number: _____ expiry date:_____
signature: _____
name: _____
address: _____
_____post code: _____

the drawing-room graphic services ltd.
box 86627 north vancouver b.c. V7L 4L2

SOL SOL SOL SOL SOL SOL
Canada's Conservation and Renewable Energy Magazine
Annual Subscription Rate $40
FREE Sample Copies Available From:
Solar Energy Society of Canada
3 — 15 York Street
Ottawa, Ontario K1N 5S7



albo

Dryer Application

Electric dryer installation simplified with the albo 90° plastic fitting

send SASE for info sheet

ENEREADY

6860 AntrimAvenue, Burnaby, British Columbia, Canada V5J 4M4

FRESH AIR
FOR ALL REASONS™

WET DIRTY STALE

DRY CLEAN FRESH

QUALITY VENTILATION PRODUCTS SINCE 1980

vanEE®

INDOOR AIR QUALITY SOLUTIONS

CES INC.
3310 MILLAR AVE
SASKATOON SK S7K 7G9

CANADA 306 242·3663
USA 800 667·3717
FAX 306 242·3484

HOT 2000

WHAT IS IT?

HOT2000 is an advanced approach to the design and modelling of energy efficient structures.

HOT2000 is an easy-to-use computer program designed to assist builders, architects and engineers design low-rise residential buildings. Utilizing current heat loss/gain and system performance models, the program aids in the simulation and design of buildings for thermal effectiveness, passive solar heating and the operation and performance of heating and cooling systems.

WHAT CAN IT DO FOR ME?

HOT2000 lets you input comprehensive data on proposed building design, analyze the expected heat loss/gain, and revise and test altered designed until a satisfactory design is achieved.

Contains extensive weather data, several models for HRV, foundation, water heating systems, and more.

HOW TO GET HOT2000

HOT2000 is available from the Canadian Home Builders Association (CHBA) in either a Canadian or U.S. version at the following prices:

- $120.00 (Cdn) for the Canadian version
- $150.00 (US) for the USA Version (contains US weather data)
- Price includes User and Reference Manuals

To order HOT2000, complete the attached form and send it with a cheque or money order to:

HOT2000 Sales
CHBA
Suite 702, 200 Elgin St.
Ottawa, Ont. K2P 1L5
Tel: (613) 230-3060

ORDER FORM

Please send me
_____copies of HOT2000 Canadian Version ($120.00 Cdn) per copy
_____copies of HOT2000 USA Version ($150.00 US) per copy
IBM Mac

My cheque money order in the amount of _____is enclosed. Make cheque Payable to Canadian Home Builders' Association

Name _____

Organization _____

Street Address _____

City, Prov/state _____

Postal/Zip code _____

Telephone No. _____

nificant in places such as around the perimeter of the attic where the sloped roof rafter or truss heel limits the space available for insulation. In these areas both the under insulated area and the degree of under insulation may be reduced by using a higher density insulation such as cellulose with its higher R-value.

In the attic, wind action and convective air currents can further reduce the R-value of insulation. The lighter the density of fibrous insulations the less resistance there is to air movement or leakage. The low density blown glass fibre, even if installed at its design density of 1 pcf, is vulnerable to air leakage (it acts just like a low cost furnace filter) so it does not perform well on a windy day. Denser materials like cellulose and mineral wool are better able to resist convection currents. Wind barriers to reduce air movement through the insulation must also be installed.

On another issue, glass fibre is not environmentally friendly. It is not biodegradable and consumes considerable amounts of non renewable resources in its manufacture. The USA Environmental Protection Agency has restricted the use of fibreglass insulation in Federally funded construction.

Loose fill wall insulation

batts vs loose fill blown batt. Note snug fit of lose fill insulation

Loose-fill and spray applied cellulose insulation has been used for over fifteen years. Recent work on a technique for a spray applied moistened insulation into the exterior wall cavities of houses has been done in Edmonton. Results show that wet-sprayed wall insulation is both practical to install and trouble free in service.

Blower door tests on houses insulated with this system have shown the system also appears to reduce the degree of air leakage which would otherwise occur when using conventional glass fibre batt wall insulation.

The study aimed to determine if the wet sprayed cellulose wall insulation system functions adequately without use of a separate polyethylene air/vapour barrier. Other research has shown that moisture in exterior walls and attics is caused mainly by condensation of water vapour moved into the insulated space by convective air leakage, and that little moisture accumulation results from vapour diffusion.

A secondary objective was to determine the influence of interior alkyd paint on the vapour diffusion performance of the wall system.

A duplex house was insulated with wet sprayed cellulose in the exterior walls and dry loose- fill cellulose in the attic areas. The units were identical except that poly was omitted from the exterior wall and ceiling of one unit. In both caulking and/or gasketting was employed at framing junctions not covered by the spray-applied cellulose. The rationale was that wet sprayed wall insulation would fill the wall cavities so densely that the usual paths of air leakage would be reduced to the point where use of a polyethylene air/vapour barrier would be unnecessary.

Air leakage and exterior wall moisture levels were monitored for twelve months following construction. Data collected indicated that the moisture added to the walls during the insulating process was dissipated over the study period. Comparison of areas with and without polyethylene showed that poly did not have a major effect on the moisture levels in either the wall or attic areas of the structure, but testing indicated that the use of polyethylene sheeting in the wall did improve air tightness.

The insulation had a moisture content of 57% by weight when installed. The sheathing, sill plate and studs had moisture levels of 6%, 12%, and 9%.

Samples of the loose-filled cellulose insulation in the attic were tested for moisture content every three months. The moisture content remained constant at about 7% throughout the study period and showed no noticeable difference between the attic with ceiling poly and the one in which the poly was left out. In the walls with poly, most of the moisture was released within 30 days. In 8 months all the framing lumber was with in 2% of the moisture content at the start, but the waferboard sheathing had 7% higher moisture content.

While the air leakage resistance provided by the polyethylene sheeting is significant, the amount is probably not more than could be obtained by careful attention to sealing procedures such as those used in the airtight drywall technique.

Alkyd paint was used on the interior walls of both halves of the structure so it was not possible to reach accurate conclusions the influence of the paint on the vapour diffusion performance of the wall system. However, the lack of polyethylene in the east side and the similar performance of the west side (which had a polyethylene vapour diffusion retarder) indicates that vapour diffusion in the wall was not through the polyethylene.

Blower door air leakage tests found the unit with a polyethylene air/vapour barrier measured a leakage rate of 1.26 air changes per hour (ACH) at the beginning and 1.88 ACH one year later. The unit without the polyethylene was 2.03 ACH and 2.63 ACH a year later. Neither unit met the R-2000 air tightness criteria of 1.5 ACH, but both performed better than the average conventionally built house.

Cellulose insulation as an Air Barrier prepared by Ken Manning Can - Cells Industries Inc. with funding by Alberta Municipal Affairs.

Got a Brilliant Idea?

Have you developed a brilliant way to save time and money? Got a trick that saves you effort? If you have you could make yourself some money and even win a trip.

CMHC sponsors the JOB SITE INNOVATOR awards program. An innovation is defined as any new construction method or technique immediately useable by others in the building industry without having to purchase special equipment or products.

For information contact your local CMHC or Home Builder's Association office.

Polybutylene Pipe

A recent television report on the US "60 Minutes" TV show brought attention to polybutylene pipe. The impression may have been left that there are major problems. But are there?

Polybutylene has been used in over 120,000 homes in Canada (mostly in western Canada) with over 150 million feet of pipe installed over the past 15 years; in Europe it has been used for some 25 years. In B.C. about half the pipe is used for floor radiant heating systems, the remainder for domestic plumbing.

Reported failures in the USA were all related to the use of acetal (plastic) fittings not compatible with the stresses on a thinner pipe wall than has been used for a many years now. Most examples covered product and installations done some 10 years ago in one area. The plastic fittings that caused the problems were taken off the market many years ago.

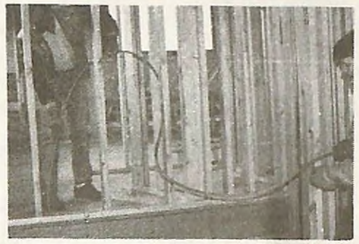
Most problems have been a direct result of poor installation practices. This underlines the importance of proper training in the use and installation of materials.

What is polybutylene?

Polybutylene is a tough and economical plastic that compares very well against copper, galvanized, CPVC or other plumbing materials, and can be used for both hot and cold water service. It is rated for pressures of 200 psi at 73°C) for cold water pipe and up to 100 psi at 180°C) for hot water pipe.

It is a lightweight, flexible material that is easy to install. It bends easily so fewer elbows are needed so depending on system layout, there may be no need to use any elbows. It can be curved and looped to suit the fixture. A range of copper, brass or polybutylene fittings are available: they may be compression type, crimp type or heat fused (polybutylene) fittings.

Polybutylene resists corrosion, rust, scale-build up and freezing. It has the capacity to expand without splitting or cracking, and can accommodate frozen water. On thawing it regains its shape. Short pipe lengths with rigid fittings (e.g. copper or brass) may not be able to withstand the pressures so there may be some freezing failures.



What to look for?

An inspection of plumbing should look at all joints and splices. Fittings should fit snugly and be properly bonded or crimped. Piping should have some slack to allow for expansion and contraction, pipes and joints should be supported. Manufacturer's recommendations should be followed.

What about other problems?

Obviously polybutylene is not a magic product without problems. The major one is that the pipe allows oxygen to migrate across the pipe wall. This means that oxygen levels in the water increase. Oxygen is a key factor in encouraging rust on any metal components the water encounters, such as the pump and heater heat exchangers; an important factor in recirculating systems such as radiant heating. The problem is not tragic as all hydronic systems face such problems to some extent. The key is to know that rust is a factor to be considered. Preventive action such as providing rust inhibitors, bleed valves, etc. will eliminate the problems.

There are no standards for heating system installations, but all heating systems manufacturers publish instructions on dealing with a range of potential problems and how they are to be dealt with. Some are dependent on the installer, some are regular preventive maintenance.

New connection fees for electric heating

The aim of B.C. Hydro's energy conservation programs is to manage demand. Because of the high cost of new electric generating capacity, and the availability of low cost natural gas, the utility is promoting alternate energy use.

Currently about 5% of new single family homes, 35 - 40% of new row houses and 85 - 90% of new low rise and high rise apartments in gas service areas use electricity for space heating.

To discourage electric space heating B.C. Hydro wants to levy a connection fee for housing using electric heating in areas served by gas. The proposed connection fees are considerable: $650 to $1,150 per unit. The thinking is that rates alone don't have a quick effect on fuel choice as developers are not strongly influenced by operating costs for the building owner even if a cheap fuel alternative is available. Electric heat is chosen because the builder is directly impacted by construction capital costs. Increasing the connection charge for electric space heating is seen as the best way to deal with this problem.

These charges would only apply in areas served by natural gas and would not apply to certified Quality Plus homes or homes using heat pumps for space heating. The exclusions provide options to customers who prefer electric heat and are willing to make an investment to minimize their space heating electricity use.

Alternate fuels, where available, make economic sense. B.C. Hydro estimates that at current rates, savings for gas space heating would be about $339/year for a single family house, $247 for a row/townhouse and $194 for an apartment.

When determining the size of the connection charge, two considerations were made. First, the charge should not exceed the net present value of the difference between long run costs and rates for electric space heating customers. Secondly, the charge be large enough to approximate the capital cost differential between the heating systems, to send an effective signal. Thus the proposed connection fees are set at: $1150 for a single family house, $1000 for a row house and $650 for an apartment.

Smart Windows: Windows of the future

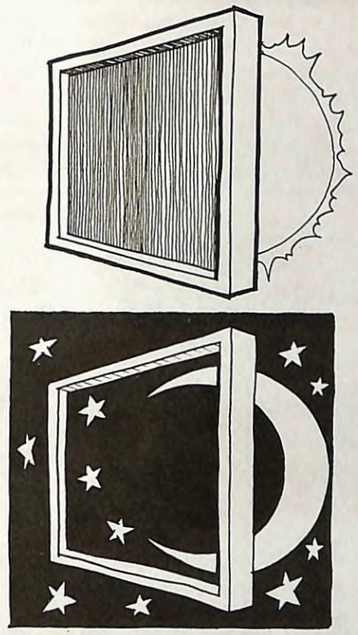
Smart Windows? Switchable glass? Electrochromic glass? These terms are not yet well known but not for long.

The sun's rays we receive cover a broad spectrum of energy, from the ultraviolet (high-energy radiation) to the infrared (low-energy radiation). In the built environment we also have long wave radiation (infrared) coming from objects or persons inside the buildings. If this latter radiation was totally reflected by the glass, preventing it from being "leaked" to the outside, we would have the perfect "greenhouse effect" and energy losses by radiation would be practically nothing.

Is it possible to maximize, reduce or eliminate this greenhouse effect as needed? Can we let sunlight in or block it out with the same window? Turn the window on to allow the warm winter sun to heat the building, but shut it off to prevent overheating? All this automatically? Sound far fetched? Something out of a science fiction?

Not so. Some of you probably already have glasses that darken in sunlight, but lighten up indoors or during the dark. Similar principles can be applied to window glass.

Researchers are now working trying to produce just such windows ("smart windows" as first coined by a Swedish research team). A more modest term to describe them is "switchable windows" because light transmission through the window can be controlled by the simple flick of a switch.



Options available now, such as mechanical blinds installed near the windows are not ideal due to problems related to energy efficiency, maintenance and aesthetic considerations. The switchable windows being researched now are primarily based on electrochromic materials, or materials that change colour upon application of a low electric field.

They have a good potential for energy management but smart windows are useful for more than just energy conservation. With their adjustable optical properties, one can effectively use incident solar radiation for heating and lighting, thus reducing the net energy consumption in buildings, especially in winter time. Control of glare and light transmission for comfort and privacy they can also provide is maybe an even more important. When the climate is warm, the cooling load can be substantially reduced if solar radiation is rejected.

The amount of savings of course will vary with different season energy costs, as well as providing significant savings in cooling equipment capitol costs.

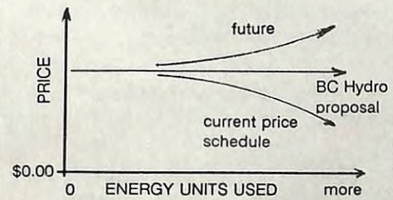
Preliminary cost studies at the Solar Energy Research Institute in the U.S.A. indicate that the cost to produce switchable glass might be in the range of $1.90 to $4.40 per sq. ft. but it is still a few years away from full scale commercialization.

"Electrochromic materials and Devices for switchable window applications" prepared for the Energy & Alternative Energy Technology Branch, EMR. Ottawa. by V. Truong, P.V. Ashrit, G Baden and F.E. Girouard, University of Moncton.

New rate structure for B.C. Hydro.

On January 15 B.C. Hydro started the process to change the utility's electric rate structure to one that encourages conservation when they filled an application with The B.C. Utilities Commission.

The new philosophy is that rates must reflect that the cost of new electricity supply which will be higher in the future so the pricing of electricity should encourage conservation and the efficient use of energy today.

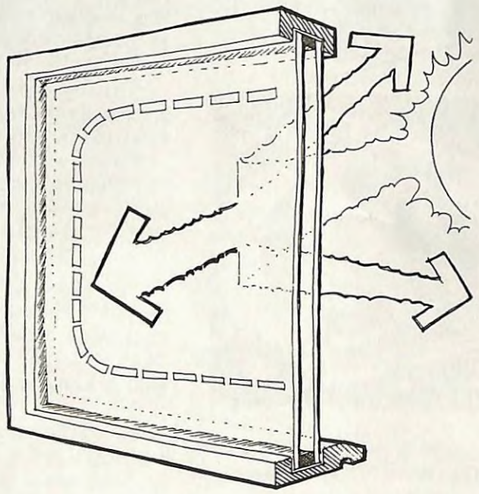


Currently, as is common with most Canadian utilities, residential and commercial rates drop as use increases. B.C. Hydro is proposing to move to a flat rate for residential and commercial customers. The plan is that in the future the rates will change to an "inverted block" structure where the rate would increase as consumption goes over a basic level - the concept of "the more you use, the more you pay"

Window labelling: coming soon

High-performance window technology has advanced significantly in recent years but windows that utilize this technology have not yet got a large market share. Confusion and uncertainly about high-performance windows are contributing to the delay in market response for more energy-efficient windows.

To help increase the market share, Energy Mines and Resources sponsored a project to develop a standard, unbiased procedure for determining the energy performance of windows and a way to present a simple energy performance rating. EMR figures that if half of the windows installed in Canada this year were R4 instead of R2 the value of first savings the first year would be 50 million dollars.



It is hoped that a voluntary, industry-supported evaluation and labelling program will encourage window manufacturers to produce high-performance windows in Canada. It would support: Building Performance Targets such as those set by the R-2000 program; Utility incentives; Performance information for Consumers and designers; Regulatory compliance; Manufacturer's claims; Comparative shopping for high-performance window products.

It will make it easier for purchasers and designers to compare windows, and be not unlike the Energuide labels for appliances or the automobile miles/gallon ratings.

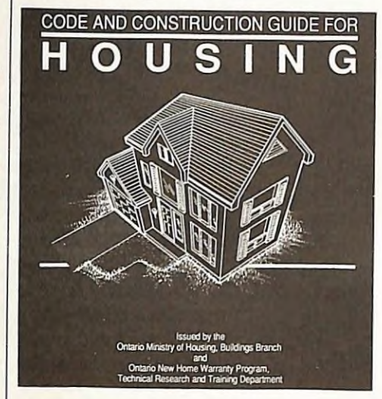
The energy performance of a window unit is much more complex than a simple R-value. To get a true total value, many factors have to be accounted for as windows have 3 zones: the centre of glass, the perimeter area of the window, and the frame. Elements that have to be considered include: shading coefficient, coating emissivity, gas fill, edge spacer, frame, weather stripping, orientation, building type and climate zone.

Typically published window ratings are for the centre glass area only. The new window labelling rating will be a single number, a composite energy rating (ER), that will incorporate the window U-value, shading coefficient and infiltration. The number will be calculated by taking solar gains (Solgain) through the window, and subtracting window heat losses (Heat loss) and air infiltration. The number could be positive or negative.

(ER = Solgains - heatloss - infiltration)

Manufacturers will have windows evaluated by actual testing or by accredited computer simulation which is a less expensive procedure than a product test.

Housing Code



The Ontario New Home Warranty program has prepared a new document that will be of special interest to all home builders, whether they're in Ontario or not.

The Code and Guide is a 2 part illustrated publication that presents material clearly by in construction sequence. The code for single, semi and row house builders has been reduced from about 400 pages down to 171 pages, written in simple clear language. It is not the official building code document, but all sections are cross referenced to the code.

Part 2 is the construction guide, organized in 16 chapters arranged in the building sequence, starting from foundations, to floor framing, means of egress, fire and sound separation through to interior and exterior finishes. This section has many illustrations with extensive commentary. Each item is referenced back to the building code. Not only does each illustrate how code requirements are met, but items that go beyond code minimum, representing good building practice are described. Where code requirements are affected by decisions made earlier, then at the appropriate spots a marker reminds you. The first print run has almost sold out already, mostly through word of mouth promotion. Colleges have already begun to use it as a text for their building courses.

A separate Code for housing only provides builders & building officials with a valuable field tool. It gives user friendly information on Codes and helps ensure uniform enforcement of requirements.

This is an Ontario publication - so those not in Ontario may wonder - what's in it for me?

Code requirements are not that unique, The Ontario Building Code is substantially the same as the National Building Code of Canada so this will be of use to builders in other areas as well. The publication was a joint venture between builders, inspectors and government.

At $40.00 it's well worth it.

Code and Construction Guide for Housing Ontario New Home Warranty Program 5160 Yonge St., 6th Floor, N.E. Tower North York, Ontario M2N 6L9

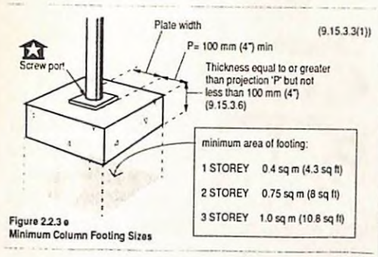
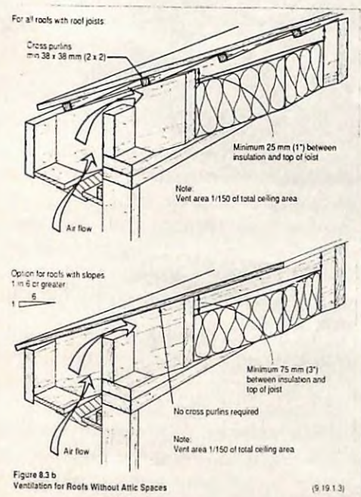
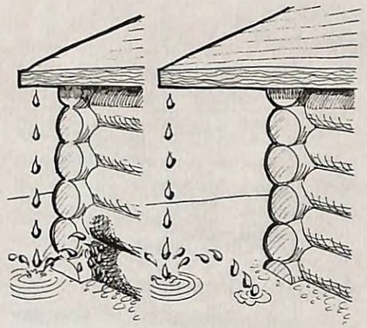


Plate width
(9.15.3.3(1))
P= 100 mm (4") min
Screw port
Thickness equal to or greater than projection 'P' but not less than 100 mm (4") (9.15.3.6)
minimum area of footing:
1 STOREY 0.4 sq m (4.3 sq ft)
2 STOREY 0.75 sq m (8 sq ft)
3 STOREY 1.0 sq m (10.8 sq ft)
Figure 2.2.3 e
Minimum Column Footing Sizes


For all roofs with roof joists
Cross purlins min 38 x 38 mm (2 x 2)
Minimum 25 mm (1") between insulation and top of joist
Note:
Vent area 1/150 of total ceiling area
Air flow
Option for roofs with slopes 1 in 6 or greater
Minimum 75 mm (3") between insulation and top of joist
No cross purlins required
Note:
Vent area 1/150 of total ceiling area
Air flow
Figure 8.3 b
Ventilation for Roofs Without Attic Spaces
(9.19.1.3)

Log Construction



Log homes are popular in many areas, not just for cottages or the remote wilderness, homes, but also for permanent residences. But log construction has its problems. CMHC has prepared a booklet that provides solutions to some common problems encountered with solid log walls.

Common problems are described, their causes defined and solutions are offered. Problems range from those that can be hazardous, leading to deterioration of the building structure, through to those that are merely aesthetic.

Most problems with log construction (as with any type of construction) can be avoided by careful design, selection of logs, construction practices and appropriate handling. From an energy conservation point of view a major concern about log homes is that they are difficult to make airtight. With good workmanship a reasonably draft free house can be achieved if proper care is taken. Extra effort is needed to maintain the airtightness over the life of the building.

Moisture

Wood is a hygroscopic material that absorbs and gives off moisture depending on the relative humidity, air temperature and the moisture content of the wood. Logs dry as they shrink and this contributes to settlement (standard practice is to allow 3/4 inch per foot of log wall height for settlement). Unlike standard construction, joints between logs must be able to move to accommodate large dimensional changes joint. Sealing materials must maintain their flexibility. In conventional construction where framing materials are covered, once the wood has dried out there is little chance for the wood so there isn't likely to be much movement.

To avoid attack by insects or fungi, wood must be protected from conditions which permit insects and fungi to flourish. This means it is best to keep it dry!

Large roof overhangs help keep rain off and thus keep log walls dry.

Energy consumption

Many factors affect the energy consumption of a building including the R-values of the building materials, air-tightness of the construction, temperatures maintained, ventilation, occupant habits and the mass of the materials used.

Thermal resistance of log walls has been a subject of discussion for some time. How to assess log houses energy consumption is under review, but the 'R' factor is still important.

Proponents suggest that log homes are energy efficient because of the 'mass' effect (in which the logs absorb energy and slowly release it as temperatures change). This is said to make log buildings comfortable with less energy consumption than the 'R' value alone would indicate for both heating and cooling. Another way to think of this is as thermal lag or thermal inertia. The thermal mass effect is now reflected in the 'R' values accepted by CMHC. But these values are still lower than insulation. The values now accepted by CMHC for thermal resistance 'R' of log walls, those found in recent field test work by Scanada Consultants Limited and recommended values from a literature review for the U.S.

Department of Energy are shown in Table1.

Table 1: Thermal Resistance (R)

	CMHC	Scanada	DOE
White Pine	1.38	0.98	1.3
White cedar	1.46	1.2	1.5

[R values per inch thickness(h-ft²-°F/Btu-in)]

There is a possibility that some trade-off's will be allowed by building officials to achieve acceptable energy efficiency in those areas where building codes have minimums insulation levels.

Moisture Problems

Problems caused by high moisture content due to water not being drained off or kept off walls include: stain and decay of the low logs in walls (at the foundation); Moisture will lead to discolouration of finished logs after a few years.

Poor detailing not allowing for the dynamic nature of the logs, especially as they settle on drying can lead to : severe twist of second floor joists; gaps in walls where logs get 'hung up' at window or door openings; unsightly finishes when settlement occurs at the junction between log exterior wall and interior frame partition wall; unsightly joints between interior frame walls and ceilings; bending of electrical entry mast; water leaks around fireplace chimney; water leaks at junction of log wall and roof over wood frame construction; water leaks at window and door openings; plumbing leaks; and electrical faults.

Air Leakage Problems

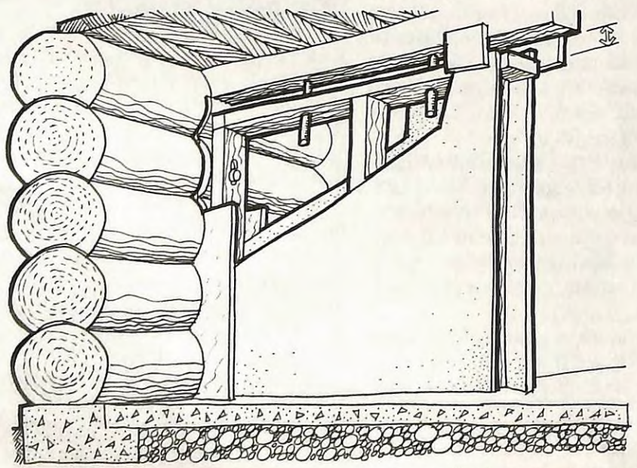
Draft proofing is important to achieve a comfortable and energy efficient home. Air leakage through joints in log walls is a direct result of poor sealing techniques.

Air movement through joints can be reduced by using proven methods for sealing joints such as: carefully formed scribed joints with cavities sealed using closed cell foam or glass fibre; double tongue and groove joints as used in manufactured logs, with closed cell foam seal/filler (sometimes called foam tape); splints of plywood used to block air movement; chinking, carefully done with proper materials (eg. closed cell foam plus a coating of a flexible sealant applied in a coat thin enough to flex).

Leakage at the joint between the foundation and base logs is a result of ineffective sealing techniques. To avoid problems, use a compressible material between foundation and sill logs - such as expanded polystyrene foam or closed cell foam. (But the sealant must have a good 'memory' - to expand to its original size after compression).

Air leakage around windows and doors can be minimized by the use of closed cell foam between window and door frames and the rough openings.

Solid Log Wall Construction prepared for CMHC by Aplin Engineering Inc.



New Trade Mark

The Council of Forest Industries of British Columbia (COFI) has developed a new mark to help buyers identify COFI plywood and assure them that they are receiving a certified product. This mark identifies plywood that is subject to third party inspection, conforms to CSA standards, and is Canadian manufactured with a fully waterproof glue bond.

Disposal of packaging materials is a growing environmental concern and an increasing expense for many. Dow Corning has been expanding the packaging choices offered for it's products of special interest are new. Collapsible "sausage" packages are being introduced for construction sealants.

Technical Research Committee News

Canadian Home Builders' Association

Drywall Discolouration

We have reported that the spots on drywall seen in new construction recently have been caused by fungicides used in drywall compounds that are no longer being used. The discolouration is triggered by ultraviolet light and hydrogen sulphide gas (a common air pollutant).

To underline the principle that a house operates as a system, another case was recently reported near Ottawa. It had considerable discolouration on all house surfaces. The house happens to be a small, tight house (but not an R- 2000 house) without a ventilation system. It was found that the high levels of sulphur compounds present in the hard water were enough to raise their concentrations inside the house and trigger other reactions. Yellow growths were found on the carpet and filters as well as the drywall. A mild bleach solution was found useful in removing the stain. Further investigation of this case is going on.

If you are still encountering any staining problems, let the TRC know about it. We need to know if there are any other problems happening.

Advanced House II: Future Concepts

Following on the success of the Advanced House built in Brampton, Ontario, the increased concern for environmentally friendly green homes, and a desire to advance housing technology beyond the R-2000 standard, 6 new Future Concept houses are to be built.

CHBA and EMR will be working together to develop these homes as a demonstration of energy efficient, environmentally responsive technologies.

The project, to be sponsored under the federal government's Green Plan, will offer the home building industry an opportunity to build homes that display the results of the latest research in low energy, environmentally responsive concepts, equipment and products.

It is hoped that 6 houses will be built in various regions of Canada to respond to regional climatic, geographic and social sensibilities.

Funding will be a partnership between EMR, provincial agencies and utilities as well as local building industry members. The homes should be completed, or be well under way by late 1992.

More details on this project will be made available as they are finalized.

Residential Fire Sprinklers

As we've reported in the past, a strong lobbying effort on the part of the plumbing industry and fire fighters has been under way for some time to make residential fire sprinklers mandatory in all new construction. Vancouver B.C. and Westmount P.Q. have already made it mandatory.

As a result of the lobby effort a number of studies have been done to evaluate the impact and cost benefits of sprinklers in single family construction. They concluded that residential sprinklers are not cost effective, and that many other life safety measures can produce better results at a far lower cost.

We can now report that the Standing Committee on Housing and Small Buildings has unanimously rejected the proposal to require fire sprinklers in one and two family buildings covered under Part 9 of the National Building Code of Canada (1995 edition). This does not mean that the issue is closed, as the National Building Code is only a model code. The lobbying effort will likely continue as some jurisdictions can, and do, modify the Code on its adoption. However, the decision of the committee reduce the chances that sprinklers will be mandated across the country.

Other fire protection measures, including upgrading smoke alarms, are likely to be required.

Publications and Videos

Would you get some benefit from a video on air sealing? on ventilation system design and installation? on new framing techniques? or some other topic? If you would like to have some material on a specific topic, would find it useful for your own continuing education or for your corporate or association's continuing education program, then let the TRC know.

The Technical Advice and Publications subcommittee is reviewing materials available and the industry's needs for new publications and support materials (print or video). Let TRC know your needs.

Ventilation Task Group

This industry task force is hoping to have a position paper on residential ventilation soon. It will include an analysis or current practices and standards (including CSA F326).

Saskatchewan Flooring Survey

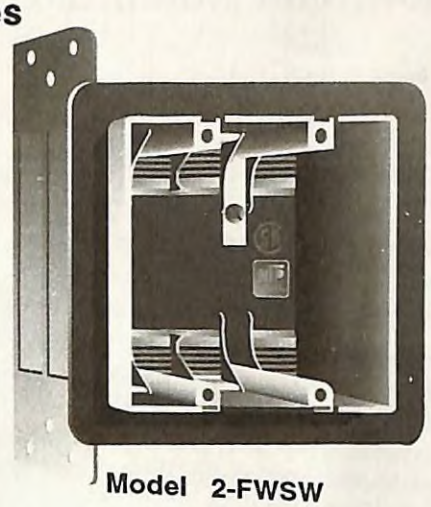
This project is trying to ascertain the nature of subflooring problems that have been noted in recent years, especially on the prairies. Funding has been obtained, and the Saskatchewan Research Council has been contracted to be project manager for the work.

The Technical Research Committee (TRC) is the industry's forum for the exchange of information and to focus attention on technology problems faced by the housing industry in Canada. Membership includes builder members and representatives from industry, standards and government bodies with an interest in housing. Anyone facing a problem, having a technical question, or suggestions for research is encouraged to contact the local Home Builders' Association technical committee or to the TRC directly.

To contact the TRC:
Canadian Home Builders' Association
200 Elgin St. Suite 502 Ottawa, Ont.
K2P 1L5 Tel: (613) 230-3060

Airtight electrical boxes

* Builder friendly
* Energy efficient - reduces heat loss
* 2 hour fire rated
* Made from G.E. Noryl™ non toxic plastic for strength and flexibility
* Nailing flange for easy installation - no need to measure for ½" drywall
* Labour saving installation



Model 2-FWSW

* Large capacity box
* Internal screw bosses for all devices
* Easy access to bottom mounted ground screw
* Hinged cable entry tabs
* Single, double, and octagonal boxes
* Drywallers only screw board on each side of the flange to form an airtight finish
* CSA & UL approved

NU -TEK PLASTICS INC.

NU-TEK PLASTICS INC.

#25 - 11151 Horseshoe Way, Richmond, B.C. V7A 4S5
Tel: (604) 272-5550 Fax: (604) 272-5551

distributor enquiries welcomed

SUBSCRIBE TODAY!

SOLPLAN REVIEW is an independent Canadian newsletter published 6 times per year to provide news, technical details, new product information, insights and commentary on developments covering all aspects of building science and energy efficient building practice for new and retrofit residential construction.
SOLPLAN REVIEW serves the needs of professional and interested lay persons. Technical information is presented in a clear, concise manner, without resorting to jargon.
YES, I WANT TO SUBSCRIBE TO SOLPLAN REVIEW

In Canada: 1 year: $38.52 ($36.00 + 2.52 GST)
2 years: 72.76 ($68.00 + 4.76 GST)
USA and other foreign: (u.s.a. and other foreign in u.s. funds).
1 year: $ 43.00 per year; 2 years: 82.00

payment enclosed please bill us P.O. # _____

please charge to credit card:
VISA MASTERCARD AMERICAN EXPRESS

card number: _____ expiry date: _____

signature: _____

name: _____

address: _____

_____ post code: _____

the drawing-room graphic services ltd.
box 86627 north vancouver b.c. V7L 4L2

THE NEW

AIRCARE™

RESIDENTIAL VENTILATION PRODUCT LINE

- Central Exhaust Ventilators (CEV's)
- Swedish through-wall Draft Free Fresh Air Inlets with filters
- Italian through-wall and through-window Low Noise Fans
- Recirculating Central Ventilators (RCV's)
- Heat Recovery Ventilators (HRV's)

OUR INNOVATIVE FEATURES WILL RESULT IN LOW TO MEDIUM INSTALLED COST, CONTINUOUS DISTRIBUTED VENTILATION SYSTEMS.
The benefit:
"AFFORDABLE INDOOR AIR QUALITY"

Specialist Ventilation Dealer enquiries invited.

ENVIROSCIENCE PRODUCTS LTD.
1962 West Broadway, Vancouver, B.C. V6J 1Z2
Phone (604) 734-4211 Fax (604) 734-0520